Memorandum

U.S. Department of Transportation
Federal Aviation Administration

Subject:	INFORMATION: Parts Manufacturer Approval (PMA) for Critical Propeller Parts	Date:	December 17, 2001
From:	Manager, Engine and Propeller Directorate, Aircraft Certification Service	Reply to Attn. of:	Jay Turnberg, ANE-110 (781) 238-7116 or jay.turnberg@faa.gov
To:	Manager, Aircraft Engineering Division, AIR-100 Manager, Aircraft Manufacturing Division, AIR-200 Manager, Certification Procedures Branch, AIR-110 Manager, Brussels Aircraft Certification Staff, AEU-100 Manager, Engine Certification Office, ANE-140 Manager, Engine Certification Branch, ANE-141 Manager, Engine Certification Branch, ANE-142 Manager, Boston Aircraft Certification Office, ANE-150 Manager, New York Aircraft Certification Office, ANE-170 Manager, Airframe and Propulsion Branch, ANE-171 Manager, Rotorcraft Directorate, ASW-100 Manager, Rotorcraft Standards Staff, ASW-110 Manager, Airplane Certification Office, ASW-150 Manager, Rotorcraft Certification Office, ASW-170 Manager, Special Certification Office, ASW-190 Manager, Small Airplane Directorate, ACE-100 Manager, Small Airplane Standards Office, ACE-110 Manager, Atlanta Aircraft Certification Office, ACE-115A Manager, Airframe and Propulsion Branch, ACE-117A Manager, Chicago Aircraft Certification Office, ACE-115C Manager, Propulsion Branch, ACE-118C Manager, Wichita Aircraft Certification Office, ACE-115W Manager, Systems and Propulsion Branch, ACE-116W Manager, Anchorage Aircraft Certification Office, ACE-115N Manager, Transport Airplane Directorate, ANM-100 Manager, Transport Standards Staff, ANM-110 Manager, Airframe and Propulsion Branch, ANM-112 Manager, Seattle Aircraft Certification Office, ANM-100S Manager, Propulsion Branch, ANM-140S Manager, Denver Aircraft Certification Office, ANM-100D Manager, Los Angeles Aircraft Certification Office, ANM-100L Manager, Propulsion Branch, ANM-140L	Policy No.	ANE-2001-35.1-R0

1. **INTRODUCTION.**

This policy establishes a uniform approach for Aircraft Certification Offices (ACOs) to evaluate PMA applications for both critical and life-limited propeller parts.

2. **REFERENCES.**

a. Title 14 of the Code of Federal Regulations (14 CFR) part 35 and §§21.31, 21.303, 45.15, and 45.14.

b. Civil Aviation Regulations (CAR) part 14.

c. FAA Order 8100.5, Aircraft Certification Directorate Procedures, dated October 1, 1982.

d. FAA Order 8110.4B, Type Certification, dated April 24, 2000.

e. FAA Order 8110.42A, Parts Manufacturer Approval Procedures, dated March 31, 1999.

f. FAA Order 8120.2A, Production Approval and Surveillance Procedures, dated January 1, 2001.

3. **DISCUSSION.**

a. Definition for Critical Propeller Parts. For purposes of this policy, the term "critical propeller part" includes all life-limited parts on a propeller and all parts characterized as critical using the definition found in FAA Order 8110.42A:

> *"Critical is a term applicable to parts, appliances, characteristics, processes, maintenance procedures, or inspections when if failed, omitted, or non-conforming, may cause significantly degraded airworthiness of the product during takeoff, flight, or landing."*

Based on this definition, most propeller parts have the potential to be critical; therefore, they should be individually evaluated. The Project Aircraft Certification Office (PACO) should coordinate with the Certificate Management Aircraft Certification Office (CMACO) when it is not evident if the part is critical.

b. Failure Conditions. The following propeller failure conditions may cause significantly degraded airworthiness of the aircraft during takeoff, flight, or landing and therefore serve as a basis for evaluating if a part is critical.

- Release of the propeller.
- Release of any portion of the propeller with sufficient energy to penetrate a fuselage.
- Significant overspeed of the propeller.
- Development of excessive drag.
- Thrust in the direction opposite to that commanded by the pilot.
- Failure that results in excessive unbalance.
- Unintended movement of the propeller blades below the established minimum in-flight low-pitch position.
- Inability to feather the propeller (for feathering propellers).
- Inability to command a change in propeller pitch.
- Significant uncommanded change in pitch.
- Significant uncontrollable torque or speed fluctuation.

- Failure of a backup system that protects against one or more of the above failure conditions from occurring in the event that the primary system fails. These backup systems include but are not limited to overspeed governors, low and high pitch stops, and pitch lock devices.

c. Critical Parts. The following parts should be evaluated with respect to the propeller failure conditions to determine if they are critical. Parts such as blades are typically considered critical, while other parts such as nuts, bolts, and erosion shields may or may not be critical. For example, a metallic propeller blade leading edge erosion shield that, when failed, would penetrate the fuselage would be considered critical, while thin plastic tape used as an erosion shield may not be considered critical.

(1) The following structural parts are generally considered critical. These include, but are not limited to, the following:

- Blades, hubs, and counter weights.
- Blade retention parts such as ferrules, blade clamps, bearings, and races.
- Blade erosion shields.
- Nuts, studs, and bolts used to mount the hub to the engine flange.
- Associated nuts, bolts, and fasteners used to attach, mate, and mount these parts.

(2) The following pitch change system parts are generally considered critical. These include, but are not limited to, the following:

- Blade pitch change pins and bearings.
- Pitch change links, yokes, and forks.
- Pressure cylinder, piston, seals, and springs.
- Beta feedback rods.
- Low and high pitch stops and pitch lock devices.
- Associated nuts, bolts, and fasteners used to attach, mate, and mount these parts.
- Oil transfer tubes and associated parts.
- Slip rings and associated electrical brush assemblies.

(3) All parts of propeller controls are generally considered critical. Propeller controls include, but are not limited to, the following:

- Governors.
- Overspeed governors.
- Propeller control units (PCU).
- Propeller electronic controls (PEC).
- Propeller servo valves (PSV).

(4) Propeller deicing systems are generally considered critical. Parts include, but are not limited to, the following:

- De-ice boots.
- Slip rings and associated electrical brush assemblies.
- Brush blocks and brushes.
- Connectors and wiring harnesses.

(5) In the context of manufacturing production approval and surveillance, all parts identified as priority parts should be considered critical propeller parts.

d. Coordination and Approval.

(1) When the PACO receives an application for a critical propeller part, the PACO must coordinate with the CMACO before making a final determination on the application.

(2) For PMA applications for critical propeller parts, a designated engineering representative (DER) may not approve findings of identicality and findings relative to airworthiness requirements by test and computation. An appropriately authorized DER may sign FAA Form 8110-3 as "recommend approval" only. Final engineering approval is made by the PACO.

(3) The PMA application for a critical part is considered a "significant project." Therefore, in accordance with FAA Order 8100.5, the PACO must notify the Engine and Propeller Directorate (EPD) Standards Staff and the office that manages the type certificate for the propeller on which the replacement part is proposed to be installed (CMACO) by electronically transmitting a certification program notification (CPN). The EPD Standards Staff will assign a project officer when they receive the CPN.

(4) The PACO must coordinate with the Manufacturing Inspection District Office (MIDO) and the Manufacturing Inspection Satellite office (MISO) to ensure that the applicant's processes will produce parts that comply with the approved design. When appropriate, the MIDO verifies the manufacturing processes of the applicant from the standpoint of its capability regarding the processes required for achieving the approved characteristics. Approval of a PMA application requires PACO approval of the design and MIDO/MISO approval of the production system.

e. PMA by Identicality. Approval of critical propeller replacement parts based on identicality requires the applicant to show that the design of the replacement part is identical to the design of the part covered under the type certificate (TC). Parts must be shown to be identical to parts certified under a TC, not other PMA approvals. The design of the PMA part includes the drawings and specifications, as well as information on dimensions, materials, and processes necessary to define the structural strength and durability of the part.

(1) For non-critical parts, the data evaluation is usually accomplished by comparing the PMA applicant's drawings, material and process specifications to the TC holder's corresponding drawings and specifications for the type design.

(2) For critical propeller parts, additional emphasis on the structural strength and durability requirements is necessary. The applicant must submit detailed information on the materials and processes to demonstrate identicality. The applicant may be required to provide the following:

- Manufacturing routing sheets, tooling requirements, process sheets, material handling/storage, and inspection requirements.

- The procedure to demonstrate manufacturing processes, inspections, and tests.

- Test results necessary to demonstrate that the manufacturing methods and processes do not alter the airworthiness of the part.

- A life management program for life-limited and life assessed parts, so the applicant will be able to implement corrective action if a failure condition is identified.

Therefore, the applicant may be required to provide appropriate details and compare the manufacturing process, from raw material procurement and first article testing through finished part, to substantiate identicality. Also, the applicant must substantiate an acceptable level of engineering and manufacturing oversight of suppliers and vendors. This is a substantial task that requires significant engineering, manufacturing, and quality control resources; the PACO should ensure that applicants seeking PMA by identicality for these types of parts possess the necessary resources. Once approved under identicality, the part is subject to the same inspection and maintenance requirements as the part approved under the TC.

f. PMA by Test and Computations.

(1) Applicants for PMA for critical propeller parts must, unless showing identicality to a part covered by a TC, show by test and computation that the design and manufacture of the part meets the airworthiness requirements applicable to the product on which the part is to be installed. The applicant must submit the information necessary to make that showing. Generally, this is the same kind of information required to obtain approval of a type design which includes the information in paragraph 3. e. (2).

(2) For propeller parts, the applicable airworthiness requirements for test and computations are the applicable amendment levels of part 35 or Civil Aviation Regulations (CAR) part 14. Regardless of the certification basis, the PACO should establish the compliance program in conjunction with the applicant, the CMACO, and the EPD Standards Staff.

g. Continued Airworthiness. Applicants for PMA for critical propeller parts must also provide a procedure to show that later revisions to the TC holder Instructions for Continued Airworthiness (ICA) will continue to be valid for the product with the PMA part installed. If the TC holder ICA or later revision of the TC holder ICA is not valid for the PMA part installed, the applicant must furnish supplementary ICA. For all life-limited propeller parts the applicant must furnish supplementary ICA.

h. Life Assessment.

(1) Section 21.31 specifies that the type design includes the airworthiness limitation section of the ICA, which defines the life-limit of a part. Regardless of the method under which an applicant seeks a PMA, a life-limited part must be substantiated. The substantiation must establish the life limits and airworthiness of that part. The required substantiating data must include tests on components produced by the applicant. Depending on the critical nature of the part, to assure the continued airworthiness of the PMA part the applicant must also provide a life management program for FAA approval.

(2) For critical parts the PACO is responsible for determining if the TC holder's part is life-limited or was life assessed. Because a propeller operates in an environment that produces cyclic loads, most critical parts have been life assessed by the TC holder during certification by test, analysis, or both. A part may be life assessed and found not to be life-limited. If the TC holder's part has been life assessed, then evaluation of the life of the PMA part is required. The compliance plan for a life assessed critical PMA part must include a proposed fatigue life methodology and test validation plan to be used for the establishment or verification of the initial part life and to support a continued airworthiness life management program.

i. Part Marking.

(1) Applicants for PMA for critical propeller parts must submit information on how the part will be marked. Parts must be marked to comply with §§45.15 and 45.14 if a replacement time, inspection interval, or related procedure is specified in the Airworthiness Limitations section.

(2) When assessing if it is impractical to mark a part in accordance with §45.15(b), the following should be considered: When it is practical for the TC holder to mark the part, the FAA expects that it will be practical for the PMA applicant to mark the part.

j. Applicant Resources. The applicant is responsible for securing the necessary technical expertise to sufficiently support the design, manufacturing, and continued airworthiness efforts required for critical PMA parts. It is essential that the PACO evaluate the validity of these resources during the design and production approval phases of the PMA.

4. **SUMMARY.**

These are the main points addressed by this policy:

- Most propeller parts are considered critical.
- An appropriately authorized DER may sign FAA Form 8110-3 as "recommend approval" only. The PACO is responsible for final engineering approval.
- The PACO must coordinate PMA applications for critical parts with the CMACO; a CPN is required.
- PMA parts approved by identicality may not deviate in any manner from the type design.
- For all life-limited propeller parts, the applicant must furnish supplementary ICA.
- For life-limited and life assessed parts, the applicant must also provide a program on how those parts will be monitored in the field and establish a life management program.
- When it is practical for the TC holder to mark the part, the FAA expects that it will be practical for the PMA applicant to mark the part.
- The applicant is responsible for securing the necessary technical expertise to sufficiently support the design, manufacturing, and continued airworthiness efforts of the PMA part.

The PACO should convey this policy to the applicant as early as possible in the PMA process to allow the applicant ample opportunity to define a detailed compliance program.

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